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Successful aging in Canadian seniors : implications for public health promotion and planning for an aging population

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Successful Aging in Canadian Seniors:

Implications for Public Health Promotion and Planning for an Aging Population

By

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Abstract

Rowe and Kahn (1987) proposed that successful aging (SA) is the balance of three components; a) absence of disease and disease-related disability, b) high functional capacity, and c) active engagement with life. In contrast, others, most notably Strawbridge and colleagues, have advocated that successful aging is better calculated using subjective measures of psychological wellbeing. This study examined successful aging in Canadian adults 60 years of age and older, using data from the Canadian Community Health Survey (CCHS), cycle 2.1 (N = 14,749). The purpose of this study was to compare a Canadian representative sample to the Strawbridge and Rowe and Kahn models and further examine if the proportion of individuals classified as aging successfully is affected by important demographic covariates (i.e., province, age, sex, martial status). Results indicate that the greatest proportion of Canadians meet the requirements for active engagement with life (69.1%) followed by functional capacity (66.6%) and the absence of disease (18.6%). These proportions decrease as the age of the participants increased. Data also indicate that 11.0% meet all criteria of SA; however, only 11.3% of Canadians fail to meet any of the criteria. Conversely, 91.5% of respondents identified being satisfied with their life and thus, met the Strawbridge criteria for successful aging. These findings provide valuable information for researchers and practitioners interested in age-specific interventions to improve an older individuals' likelihood of aging successfully.

Acknowledgements

This thesis was nothing short of a journey, a surprising adventure that I have been on for an extended period of time. There have been many lessons, times of self-reflection and moments on my 'growing-edge'. This endeavor was not without the support of many. My sincere appreciation to my supervisor, Bill Montelpare, whose flexibility, trust and humor are major contributors to the successful completion of this work. I think this was my 'Big Smokey' Bill, but it sure feels great....now! A special thanks to Alison Macpherson and Tracy Howson, whose investment in my work were important motivators.

The roots of my thesis were planted by my family and survived by their interest. Mom and Dad, your commitment to family and investment in the community always keeps me mindful of how fortunate I am! Thank you for the love of learning. I am looking forward to growing older with you.

Unfortunately I cannot guarantee that my tendencies to procrastinate will change after this. For that I will continue to bake cookies for my financé whose patience, unconditional support and true companionship, through all my frustrations, were given without hesitation or judgement. Joe, you are a gift. For each leaf on every tree....thank you.

Table of Contents

List of Tables

List of Figures

CHAPTER ONE: INTRODUCTION

Changes in life expectancy have resulted in an increased proportion of the aged, and can significantly affect health policy and public health messages (as well as personal decisions such as how much one should save and when to retire). Belief in imminent limits to life expectancy can distort public and private decision-making, as forecasting life expectancy has been used to change policy with respect to social security and health care systems. Recently, Ontario has seen a shift in the age of retirement highlighting pressing concerns around human resources recruitment and retention but also because individuals are living and working longer.

The changing population demographic in Canada due to the increase in longevity prompts the questions, "What is the national health profile of our seniors?", "How does it differ by province?", and "How might one determine whether someone is aging well?" Answers to such questions could be useful in profiling the health status of our senior population. A foundational step is to develop an understanding of the prevailing concepts of successful aging (SA) that takes into account the positive trends in life expectancy. This thesis considers two contrasting models of 'successful' aging to determine their utility as measures of health and functioning in an aging Canadian population.

CHAPTER TWO: LITERATURE REVIEW

This literature review provides a comprehensive overview of information related to the concept of successful aging. This concept has become increasingly prominent in public health discussions on the aging Canadian population.

The Burden of Chronic Disease

To date, it is estimated that of all humans who have ever lived to at least the age of 65, half are currently alive (Hilts, 2005). Such dramatic improvements to life expectancy are related to specific milestones over the last 200 years: 1) the reduction of infant and childhood mortality in the 19th and 20th centuries due to an improvement in the quality of prenatal and perinatal care, access to clean water, adequate sustenance and the management of infectious diseases (e.g., smallpox, tuberculosis, pneumonia) and, 2) the decline in mortality rates of middle-aged and older individuals mainly related to individuals taking better care of themselves and improved outcomes for individuals due to considerable advances in both science and medicine (e.g., technological advances, effective medications, innovative approaches to procedures; Aldwin & Gilmer, 2004).

As a result of such improvements, life expectancy has improved while rates of mortality have declined. Looking specifically at the 1900s we can see a shift in cause of death from infectious diseases (communicable acute diseases, often self-limiting and can be successfully treated with medications) to chronic diseases (often incurable and the treatment focus is on disease management to impede its rate of progression in attempts to limit disability; Aldwin & Gilmer, 2004).

In the early 1900s the leading causes of death were attributable to communicable diseases. People of all ages died of smallpox and tetanus, reinforcing that deaths from infectious

disease were more evenly distributed across the life span. During this time, pre WWII and the development of antibiotics, the treatment for bacterial infections was rudimentary and, as a result, often ineffective. Therefore, few cases of deaths were attributable to chronic diseases until the 1930s when their rates were prominent enough to shift the health focus from infectious diseases.

This was brought about by the discovery of how infectious diseases were spread in the early 1900s, which promoted the development of public health control measures that lead to an emphasis on research and vaccine development. Consequently, around the 1930s, with the effectiveness of antibiotics, and the improvements in sanitization and nutrition, infectious diseases were not as lethal. At this time the focus shifted to cardiovascular disease, cancer, arthritis and diabetes.

By the late 20th century the leading chronic diseases for individuals 65 years or older included heart disease, cancer, stroke, and chronic obstructive pulmonary disease (Sahyoun, Lentzner, Hoyert, & Robinson, 2001). Today cardiovascular disease (heart disease and stroke), cancer, chronic obstructive lung disease (emphysema and bronchitis), and diabetes represent the major burdens on the health care system, families and Canadian society. According to the Chronic Disease Prevention Alliance of Canada (2007), chronic diseases are the universal leading causes of death and disability.

As identified by federal, provincial, and territorial public heath officials comprising the Advisory Committee on Population Health, certain preventable diseases are of immediate concern because they are either currently prevalent, or risk factor rates for those diseases have increased. Notably, the burden of such diseases is disproportionately higher in disadvantaged populations and in older cohorts.

Shifting Population Demographics

Oeppen and Vaupel (2002) highlight the positive relationship between life expectancy in years (age) over time for women on a global scale from 1840, forecasted to 2040 – a 200 year trend. These data indicate that female life expectancy (for the record-holding country) has risen for 160 years at a steady pace of approximately 3 months/year. In 1840 life expectancy was just over 45 years whereas today the longest expectation of life is approximately 85 years (for Japanese women).

The authors suggested that the 40 year increase in life expectancy in just 16 decades is so linear that it may be the most remarkable regularity of mass endeavor ever observed. They further state that life expectancy for men has also risen linearly; however, the gap between female and male levels have increased from 2-6 years.

According to Oeppen and Vaupel (2002), world life expectancy has more than doubled over the past 200 years from 25 to 65 years for men, and 70 years for women. This transformation has yielded greater economic output and population size, which has led to an increase in the proportion of seniors. Consequently, a by-product of the increase in longevity is a dramatic increase in the number of centenarians. In the United States alone it is projected that by 2050 over 600,000 individuals will be over 100 years old, of these participants, compared to 32,000 in 1982, and 61,000 in 1999 4/5 will be women (Aldwin & Gilmer, 2004). In consideration of Canada's aging senior population, it is imperative to effective planning and the sustainability of both quality and accessible resources, that the variables contributing to the utilization of health care system resources and community support services by this population are examined to yield knowledge and identify implications. Rosenberg and Moore (1997), examined the utilization of physician and institutional services with National Population Health Survey

data (1994-1995) and identified that individuals 75 years and older were more apt to have health problems and thus use health care services compared to other Canadian adults. They further highlighted low income, single dwelling elderly women as a specific vulnerable group, requiring access to both medical and nonmedical services in support of continued aging in the community setting.

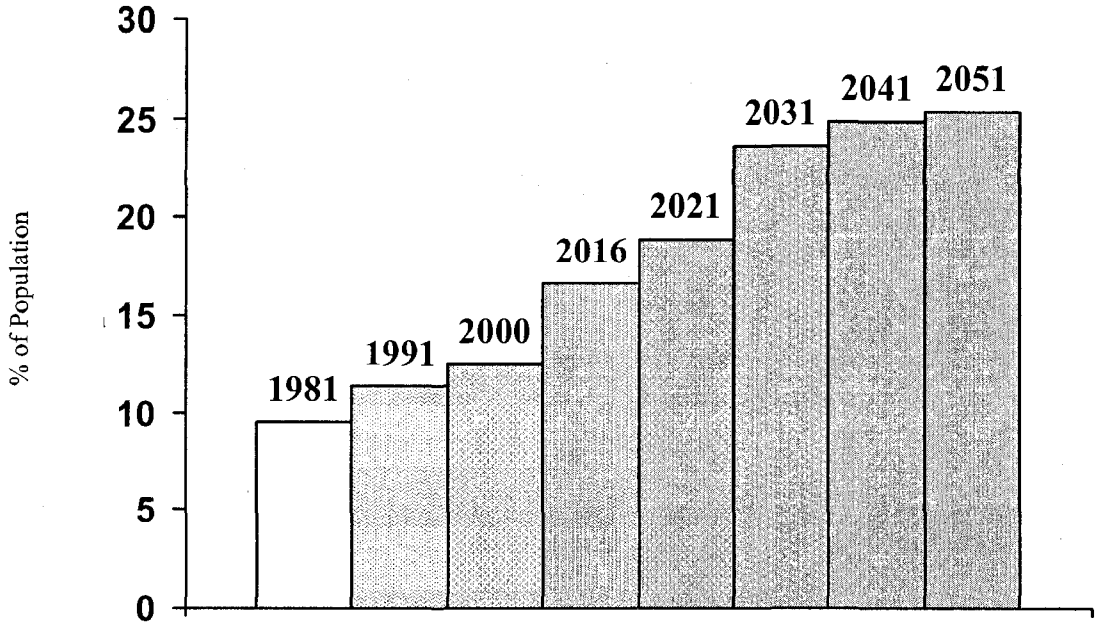
Looking more specifically at the Canadian aging population, the first of the baby boomers (born post WWII – 1946-1964) reached 60 years of age in 2006. They have reshaped every aspect of our society as they have moved through it, including the workforce, education, and now healthcare and retirement. Statistics Canada (2007) identified that the 2001 Canadian Census captured 3,796 Centenarians nationally (80% were women). Perhaps most interesting, looking at the percentage of Canadians 65 years of age and older, Figure 1 shows that in the next 50 years, over 25% of the Canadian population will be 65 or older, illustrating how we are living longer, and the importance of research in this area to inform and prepare the health care system and community supports in appropriately responding to the needs of an expanding elderly population (Canadian Centre for Activity and Aging, 2007).

Aging Re-defined

Due to the considerable increase in those reaching advanced age, researchers have had to reconsider traditional definitions of old age. For instance, a common gerontological question is "When does late life begin?". The literature shows an inconsistency in definitions of older populations, sometimes including those as young as 50 years of age. As highlighted by Neugarten (1975), an emerging consensus that late life is not homogeneous has lead to the use of age groupings to distinguish categories of older age such as the young-old (those between 65 and

79 years of age), the old-old (between 80 and 99 years of age), and the oldest old (those 100 years of age or older – Centenarians).

Figure 1: Projection of Canadians Age 65 or Older



Source: Canadian Centre for Activity and Aging, 2006

Typically, the young-old are healthy and functional, while the old-old are more likely to be physically and cognitively in need of support and Centenarians (oldest-old) are such a dynamic class that it is difficult to generalize to this group as the range in their capacities may be extreme.

Two significant issues will affect how governments and individuals can respond to these changes in our aging profile – compression of morbidity and maximum life span. Researchers examining survival tables in the early 1980s saw that large numbers of people were living longer, while the demographic trend indicated that the onset of debilitating chronic diseases was delayed (Fries & Crapo, 1981).

It was proposed (Fries, 1989) that people would remain healthy in their later life until a couple of months before their maximum life span (85 years) at which time they would die after a short period of disability, most likely from a chronic disease. Conversely, others argued that a greater number of people living longer would result in prolonged morbidity – people living longer with disease and disabilities (Roos, Havens & Black, 1993). The second issue relates to whether humans have a maximum life span. The notion of a fixed life-span by researchers lead to the belief in an absolute limit to life expectancy. In 1928, Louis Dublin calculated that the limit of life expectancy for both men and woman was 64.75 years (at which time the life expectancy in the US was 57 years; Aldwin & Gilmer, 2004). Some scientists perceive it unlikely that a fixed life span limit or that a "species-determined" limit exists for humans while others argue there are genetic limitations to life span and average life expectancy will not exceed 85 years (Olshansky, Carnes & Desesquelles, 2001).

It is interesting to note some of the current average life expectancy projections. For instance Aldwin and Gilmer (2004) highlight that by 2040, the average life expectancy for women will be in the 90s, and the average life expectancy at birth in the U.S. would reach 83 years by 2050, an increase of 7 years from 1999. Such projections reinforced the value in examining both the health status and utilization patterns of the aging Canadian population to appropriately inform the training of health care providers and system decision-makers, particularity at a time when investments are being made in health care reform. In Ontario, such investments are seen through the development of Local Integrated Health Networks (LHINs), Family Health Teams (FHTs) and Community Health Centres (CHCs).

Throughout the 1970s and the mid 80s, there was recognition of social, economic and health care consequences to an unprecedented aging (American) population; as a result, interest

in gerontology and geriatrics increased. However, a conceptual foundation imperative to understanding all aspects aging (e.g., biological, social, psychological) was missing. Consequently focus shifted to the negative aspects of aging (e.g., disability, disease and chronological age) without appropriately looking at the effects of lifestyle and other psychosocial factors on well-being.

The MacArthur Foundation Study of Successful Aging

With the initiation of the MacArthur Foundation in 1984 and the intention of establishing robust interdisciplinary science through ongoing collaboration, experts from various disciplines worked towards one central focus – *effective functioning in later life.* The Foundation was a platform to assemble scholars from various areas of aging to develop a concept of a "new gerontology" through a long-term research program aimed at gathering knowledge for improving the abilities of older Americans. This was a significant switch from thirty years prior, when gerontologists were heavily influenced by disengagement theory - where the task of old age was defined as "letting go".

The MacArthur Study was grounded in the concept of "successful aging" – *the many factors which permit individuals to continue to function effectively, both physically and mentally, in old age* and emphasized the previously overlooked, positive aspects of aging (Rowe & Kahn, 1998). Components of the study had the goal of clarifying the genetic, biomedical, behavioural, and social factors responsible for retaining and even enhancing later life functioning.

Prior to the MacArthur Study, interdisciplinary research in the area of gerontology was lacking. The MacArthur initiative was a catalyst in the reorientation movement toward "successful aging" as an important theme of the "new gerontology". In 1987 progress was made via a movement out of the disease framework perspective and the redefinition of successful

aging, through a paper published in the journal *Science* (Rowe and Kahn, 1987). Following this shift and based on empirical evidence from the various MacArthur sub-studies, successful aging was adopted as the theme for prominent national and international meetings and research groups started to focus more of their efforts on studying successful aging.

One of the more significant effects of the MacArthur initiative was on the National Research Agenda on Aging and the strategic plan for research in gerontology and geriatrics. Units of the National Institutes of Health established funded research programs specifically to understand successful aging. The theoretical and empirical basis of this concept was that success as an older person was largely determined by behaviour. Through health promotion, not just disease-prevention, initiatives (e.g., healthy eating, physical activity and tobacco cessation) seniors can attain high-quality, disease-free years. Rowe and Kahn (1998) identified that older adults have been shown to recover lost function and decrease risk for disease through the adoption of lifestyle changes).

On the Modifiability of Aging

Aging and Carbohydrate Metabolism

It is well know that advancing age is associated with progressive impairments in one's ability to metabolize glucose, and such carbohydrate intolerance with age can put one at risk for diabetes, even in the absence of disease. However, there is some evidence that carbohydrate intolerance in older adults is caused by non-biological factors. Reaven and Reaven (1985) suggested that dietary or exercise modifications may substantially lessen the development of carbohydrate intolerance and insulin resistance with age. This finding has been strongly supported by research that shows improvements in glucose tolerance after exercise in young adults and diabetics, and that exercise improves insulin resistance and glucose intolerance in

older individuals (James, Kraegen, Chisholm, 1984; Leblanc, Nadeau, Boulay & Rosseau-Migneron, 1979; Seals, Hagberg, Hurley, Ehsani & Holloszy, 1984; Tonino, 1989).

Aging and Osteoporosis

In addition to the progressive decline in bone density for men and women after maturity, osteoporosis (bone density loss to the degree at which minimal trauma can result in fractures) is projected to be prevalent through rates of vertebral fractures in one-third of women over 65 years of age, and through hip fractures in one-third of women and one-sixth of men over 81 years of age (Riggs & Melton, 1986).

Although osteoporosis has been recognized as a variable process with many possible causes, aging is considered a key factor. In their research review, Riggs and Melton identified three separate components that contribute to age-related bone loss:

1) Intrinsic aging – the decline in bone mass with age for men and women;
2) Effect of menopause in women; and
3) The net effects of extrinsic factors (e.g., cigarette smoking, heavy alcohol intake, inadequate calcium intake).

In addition to the identification of modifiable factors, studies also suggest bone loss can be minimized with the adoption of moderate exercise programs (Aloia, Cohn, Ostuni, Cane & Ellis, 1978; Krolner, Toft, Nielson, & Tondevold, 1983; Smith, Reddan & Smith, 1981). Thus, osteoporosis, once considered representative of the "normal" aging process, is variable and can be influenced both by aging and non-aging factors; reductions in bone density once associated with "usual" aging may be somewhat modifiable or preventable.

Aging and Cognitive Function

Studies indicate that cognitive loss (e.g., fluid intelligence – inductive reasoning and spatial orientation) in later life considered characteristic of aging is in part attributable to extrinsic factors and thus may be preventable (e.g., vanGelder et al., 2004). Furthermore, empirical research suggests that such cognitive losses may be reversible (Bartzokis et al., 2001).

Psychosocial Factors and Patterns of Aging

Extrinsic psychosocial properties have considerable influence on the well-being of older people. Autonomy (or control) is the extent to which individuals are able to make decisions regarding such things as choice of activity, method and manner of engagement, timing, and pace. The extent to which autonomy and control are either encouraged or deprived is a key factor to whether aging is successful or usual on various physiologic and behavioural dimensions. Additionally, social support (or connectedness) although not consistently defined or measured, has an empirically consistent relationship to indicators of health and well-being, particularly autonomy (House & Kahn, 1985). Notably, teaching, encouraging, and enabling are autonomy–increasing modes of support, while constraining, warning and "doing for" teach helplessness.

Evidence shows that membership in social networks and support is associated with lower mortality risk and that support-disrupting life events (e.g., bereavement and relocation) have negative effects on mortality and morbidity (Penninx et al., 1997). In cases where this has varied, it is usually explained by individuals in the upper age range having some degree of expectation of loss and thus their readiness to cope. This explanation has been echoed by Kasl and Berkman (1981) who suggest that variance may be an outcome of an individual's level of preparation and the quality of their environment (see also Berkman, 1995).

Further exploration is needed to identify support (e.g., objective and perceived), type of support required (material, informational, emotional), and the effect of such supports on other psychosocial predictors of success, as existing evidence indicates that social support has the ability to mitigate the negative effects of disrupting life events in later life (Aldwin & Gilmer, 2004). It is also important to understand the effect of psychosocial factors on health by integrating psychosocial causes with biological outcomes, not just morbidity and mortality, and ways in which causes and effects are linked.

Establishing a Framework for Successful Aging

In the late 1950s it was recognized that in order to study successful aging it was necessary to distinguish pathologic changes from those thought to be age –determined. Thus, participants have been excluded from studies if their "age-determined" responses or behaviours were contaminated by the process of a disease or the disease itself; as a result, exclusion guidelines were developed purposely to yield a category of "normal aging". Typically study designs control for the presence or absence of disease. Studies that have screened participants for disease have demonstrated the major effects of age on both clinically relevant variables (i.e., vision, hearing), and characteristic changes to both cognitive and behavioural functions.

Highlighted in John Rowe and Robert Kahn's 1987 foundational paper *Human Aging: Usual and Successful,* research in aging has ignored the "substantial heterogeneity of older persons", and instead focused on "average age-related losses" of the aging process, exaggerating the effects of the aging process while underestimating the relationship of other influential variables (e.g., psychosocial factors, individual behaviours, diet and exercise).

Rowe and Kahn were of the opinion that those aging successfully would exhibit little to no age-related declines in physiologic functioning, while individuals aging "usually" would

appear to have disease-associated deterioration, which was often identified as the effects of age. The authors argued that what most considered effects of aging were, instead, effects of disease.

The Rowe and Kahn article has been enormously influential to understanding the concept of successful aging, arguably because it was the first to outline explicit criteria to determine 'success'. Rowe and Kahn (1987) defined successful aging as the ability to maintain 3 key behaviours and characteristics:

1. Avoiding disease and disease-related disability;
2. Maintain mental and physical functioning; and
3. Continuing/active engagement with life (e.g., relationships with others, productive behaviours).

One still needed to meet all 3 criteria to be classified as aging successfully, thus still describing a relatively small portion of older persons as aging successfully with the exclusion of those with chronic conditions. Although the Rowe and Kahn model has been criticized (e.g., Strawbridge, Wallhagen & Cohen, 2002), it had a number of positive consequences. First, that all age-related deficits could not be excused as inevitable concomitants of old age. Second, environment and lifestyle factors were promoted as ways well-being could be improved, and finally, the focus in gerontology and geriatrics shifted from those doing poorly to those doing well. In their view, successful aging is dependent upon an individual's choices and effort; successful and unsuccessful aging is not just the difference between sickness and health (pathologic and nonpathologic states) – it is not simply absence of disease.

Rowe and Kahn clearly state that the concept of successful aging does not mitigate the concern with explicit diseases, their causes, or the need to understand the dominant patterns of aging. However, the concept of successful aging adds a focus on the heterogeneity within age

groups and on the clarification of factors that explain success. Rowe and Kahn recognized that society does not make the transition into older ages easy, and advocated the need to make resources for successful aging more widely understood to thus increase the number of individuals who will age successfully.

Distinction between usual and successful aging was propelled by discoveries regarding risk factors for diseases. For example, age-linked increases in blood pressure, body weight, cholesterol levels thought usual in a population were risk factors for cardiovascular disease; characteristics that were once considered age-intrinsic are largely confined to prosperous industrial countries, not agricultural ones.

Rowe and Kahn (1987) suggested that research looking at both the risks, associated with usual aging and strategies to impede such risks would clarify the ways to facilitate transition from usual to successful aging. Of particular importance is the examination of the factors that determine the course of function with age and look at potential moderators of the aging process (e.g., the effect of diet, exercise, and nutrition) regarding the prospects for avoiding or possibly reversing functional loss with age.

An underlying benefit to looking at health-related variables in a population representing "normal aging" is that we can look at the influence of age on the presentation of disease, the probable responses to treatments and the likelihood of complications. Looking at non-diseased changes is important because the change reflect the aging process and allows researchers to look at the precursors of a disease pathway.

Criticisms of Rowe and Kahn's Model of Successful Aging

Almost from the onset, Rowe and Kahn's model was met with criticism from some in the gerontological community. Rowe and Kahn's labeling of "normal, usual, successful" came with

interpretations that could develop into stigmas. Looking at disease vs. non-diseased or disease-related vs. age-determined limits an interpretation that what is "normal" aging is natural, while in research, emphasis on "normal" has focused attention on learning what "most" older individuals do and do not do. The risk is the developed perception of "gerontology" of the usual.

Researchers interested in examining successful aging commonly use Rowe and Kahn's (1987) definition, usually modifying successful aging to be inclusive of individuals showing minimal versus no disease and disability, or those exhibiting high levels of physical functioning. However, even with modified criteria, the proportion of individuals classified as successfully aging is typically 20-33% less (Guralnik & Kaplan, 1989; Roos & Havens, 1991; Seeman, Rodin & Albert, 1993). Some researchers were attracted to the original Rowe and Kahn definition as it implied reaching older age without age-associated disease or considerable physiologic decline was possible (Masoro, 2001).

William Strawbridge and other researchers have recognized the utility of definitions of successful aging that were broader and more inclusive of signs and symptoms of chronic disease. However, it was perceived that the majority of definitions focused too much on health and physical ability as opposed to a broader conceptualization of overall well-being (Schmidt, 1994; Manton & Stallard, 1991; Strawbridge, Cohen, Shema & Kaplan, 1996; Baltes & Carstensen, 1996).

Thus, Strawbridge et al. (2002) examined successful aging as popularized by Rowe and Kahn, with an interest in capturing and reflecting well-being – an individual's perception of their own aging, which was largely missing from Rowe and Kahn's definition. Strawbridge and colleagues focused on comparing the prevalence and characteristics of older individuals from a representative sample who self-rated as aging successfully, versus those classified by Rowe and

Kahn's criteria as successfully aging. To measure self-rated successful aging, participants were asked the degree to which they agreed or disagreed with the statement: "I am aging successfully (or aging well)". Those who agreed strongly to the statement were classified as aging successfully.

Findings showed that half (50.3%) self-rated as aging successfully compared to under 20% (18.8%) by Rowe and Kahn's criteria, noting that most participants with chronic conditions and physical limitations still rated themselves as aging successfully. Overall the proportion of individuals who indicated they were aging successfully declined with greater chronic conditions and was lower for individuals with functional difficulties. The self-rated definition for successful aging may be useful for highlighting older individuals with low levels of well-being who may benefit from additional assessment or intervention.

Strawbridge et al. (2002) reiterated that successful aging is a complex concept and further examination into why some of their participants with no chronic conditions rated themselves as not aging successfully while others perceived themselves to be aging successfully may shed light on how quality and quantity of life may be promoted.

Rationale for the Current Study

The Rowe and Kahn (1987) and Strawbridge (2002) models represent the two opposing views, or more simply, the dichotomy, of what constitutes successful aging. Both are unique but valuable contributions to the literature and focus on aging well throughout the lifespan. However, our understanding is far from complete. To progress in health promotion and disease prevention in the elderly, Rowe and Kahn recommend that gerontological research should:

a) Include distinctions between usual and successful aging (including the explanation of the heterogeneity of older people);

b) Concentrate on transitions in later life that have functional importance (specifically those that could influence positive function-expanding directions);

c) Study extrinsic factors that influence successful aging in interdependent combinations as well as on their own; and

d) Foster aging research that links the psychosocial and the physiologic.

It is clear that individuals are not only living longer, but many are doing so with at least one chronic illness. This creates a significant burden on the health care system with regard to human resources, infrastructure capacity, economic burden, which directly impacts quality of life. Given these costs, advancing integrated work on chronic diseases and developing a better understanding of successful aging will support efforts to address the sustainability of the Canadian health care system and to mitigate the overall burden of those diseases.

The purpose of this study is to provide a descriptive profile of successful aging in Canada by using data from the Canadian Community Health Survey (CCHS), in the hopes that this information can inform public health policy and messaging.

CHAPTER THREE: METHODS

Sample

The study cohort consisted of Canadian citizens who participated in cycle 2.1 of the CCHS conducted by Statistics Canada between January 2003 and December 2003. The CCHS is a cross-sectional survey using computer and assisted personal and telephone interview methods. The survey was conducted nationally (inclusive of all provinces and territories) to obtain a large sample of Canadians; as a result, cycle 2.1 provides a highly generalizable representation of the Canadian population. It should be noted that the CCHS did not collect information from populations on Indian reserves, remote areas, or Canadian Forces Bases.

The total sample size of cycle 2.1 was approximately 135,000 respondents, and the overall response rate of the survey was 80.7%. Although the sample of the CCHS included household residents above the age of 12 from all provinces and territories (126 health regions), inclusion criteria for the present study sample were that the respondent be 60 years of age or older and have answered all questions related to the variables under examination, resulting in a dataset of 14,749 participants. Due to the questions used in the present analysis, data were only obtained from 4 provinces (Alberta, British Columbia, Manitoba, Ontario).

Although the goal of the CCHS was to collect information representative of the overall Canadian population, a random sampling method was not used. In some cases groups of respondents were deliberately over-sampled in order to ensure that information collected on that group was accurate. In order to compensate for the deliberate over-sampling of particular groups, population weights supplied by Statistics Canada were applied to ensure that all cases were representative of actual population trends and statistics. In order to create accurate

measures of variance, the sample population weights were re-scaled, standardized, and re-applied to the dataset.

Dependent Variables

Model 1: Rowe and Kahn

The Rowe and Kahn (1987) model of Successful Aging requires the measurement of three distinct components: avoidance of disease or disease-related disability; high cognitive and physical functional capacity; and active engagement with life. Variables from cycle 2.1 of the CCHS were identified to reflect each distinct component.

Avoidance of disease or disease-related disability was captured using the CCHS variable, "presence of chronic conditions". In the CCHS, respondents were asked about current "long-term conditions that are expected to last or have already lasted six months or more and have been diagnosed by a health professional." These conditions included allergies, asthma, fibromyalgia, arthritis, rheumatism, back problems (other than arthritis), high blood pressure, migraine headaches, chronic bronchitis, emphysema, chronic obstructive pulmonary disease, diabetes, epilepsy, heart disease, cancer, intestinal or stomach ulcers, stroke, urinary incontinence, Alzheimer's disease or other dementia, cataracts, glaucoma, thyroid conditions, chronic fatigue syndrome, chemical sensitivities, schizophrenia, mood disorders such as depression, anxiety disorders such as obsessive compulsive disorder, developmental disorders such as autism, learning disabilities such as dyslexia, eating disorders such as bulimia, and/or any other long-term physical or mental condition. Respondents stating the presence of *any* of these chronic conditions were classified as having a chronic condition.

Of the attributes included in the CCHS variable, "presence of chronic conditions", the following 14 were selected and collated into a recoded variable: asthma, fibromyalgia, arthritis

(rheumatoid arthritis, osteoarthritis) or rheumatism (excluding fibromyalgia), high blood pressure, chronic bronchitis, emphysema or chronic obstructive pulmonary disease (COPD), diabetes, heart disease (angina, congestive heart failure), cancer[i], urinary incontinence, stroke, cataracts, glaucoma, and back problems (excluding fibromyalgia and arthritis). The CCHS attribute, Alzheimer's disease and other dementias was not available in the data set to select for inclusion in the computation.

The CCHS scoring system used to determine if a respondent could be classified as 'yes' or 'no' to presence of chronic conditions by each attribute was 1=yes, 2=no. Thus, for the 14 attributes selected, an overall score of 28 indicated that the respondent answered 2=no to each chronic condition attribute (14 attributes x a score of 2 =28 overall), thus meeting Rowe and Kahn's first criteria for aging successfully – avoidance of disease and disease related disabilities. Any overall score of 27 or less indicated that the respondent had identified with having at least one of the 14 possible chronic conditions. Frequency analysis indicated that 18.6% of respondents did not identify a chronic condition and thus met the first criteria for SA; 81.4% scored 27 or less, not meeting the criteria for avoidance of chronic disease or disability.

The second component of Rowe and Kahn's model, ***high cognitive and physical functional capacity***, was encapsulated in the CCHS database with the "restriction of activities" scale. This scale examined respondents' ability to perform the following 7 categories of activities of daily living: preparing meals; shopping for groceries and other necessities; completing everyday housework; doing heavy household chores (washing walls, yard work); personal care (washing, dressing, and eating); moving about inside the house; and paying bills. If respondents reported requiring assistance (as a result of a physical condition, mental condition

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[i] Cancer for females includes breast, colorectal, skin melanoma and skin non-melanoma; Cancer for males includes prostate, colorectal, skin melanoma and skin non-melanoma.

or poor health) for *any* of the tasks of daily living, they were classified as having a functional limitation.

The CCHS scale for "restriction of activities" was 1=yes, 2=no; as a result, the lowest possible score indicating a 'yes' response to all 7 attributes was 7 and a score of 14 indicated the respondent answered 'no' to each. Results of computed frequencies indicated that 66.6% of respondents did not need assistance with an activity of daily living and thus met the second criteria for SA; 33.4% scored 13 or less, not meeting the criteria for *high cognitive and physical functioning*.

The third component of Rowe and Kahn's model, ***active engagement with life***, was more difficult to ascertain from the CCHS data. It is quite difficult to measure an individual's engagement with life and, as a result, any designation of 'engaged' versus 'unengaged' is inherently subjective. Due to this subjectivity, a conservative approach using multi-level criteria was established to identify level of engagement with life by using three measures from the CCHS: *hours of sedentary behaviour, sense of belonging to local community* and *voluntary involvement in organizations*.

The CCHS variable, "*hours of sedentary behaviour*" considers the total number of hours in a typical week spent in sedentary activities (computer, computer games and internet, video games, watching television/video, and reading). For all activities, time spent at school and/or work was excluded. Respondents were identified as either accumulating ≥35 hours per week of sedentary behaviour (recoded as 2) or <35 hours per week (recoded as 1). Differentiation for hours of sedentary activity per week was arbitrary; however, ≥35 hour per week was chosen to reflect 5 or more sedentary hours per day across a 7 day week period.

Taking into appreciation, more than just sedentary hours, the CCHS measures, *sense of belonging to local community* and *involvement in voluntary organizations* were included in identifying active engagement with life. The scale for *sense of belonging* asked respondents to describe their sense of belonging to their local community as: very strong (1), somewhat strong (2), somewhat weak (3), or very weak (4). Responses identified as 'very strong' or 'somewhat strong' were combined and recoded as 1 and 'somewhat weak' and 'very weak' were recoded as 2.

Respondents' involvement in *voluntary organizations* was measured directly by asking if they were members of any voluntary organizations or associations (e.g., school groups, church social groups, community centres, ethnic associations or social, civic or fraternal clubs). Confirmation of membership to an organization or association was scored as 1, non-membership was identified as a 2; as a result, scores greater than 2 were omitted from the data and recoding was not required.

Using multi-level criteria, (*hours of sedentary behaviour, sense of belonging to local community* and *voluntary organizations*), an individual's engagement with life was classified as unengaged if a) the respondent acquired ≥35 sedentary hours per week *and* identified a somewhat weak or very weak sense of belonging to local community OR b) the respondent acquired ≥35 sedentary hours per week *and* was not a member of a voluntary organization or association. Two methods were used (instead of combining all three variables into on global measure) in order to ensure that the engagement with life variable was not too restrictive.

Frequency analyses indicated that 69.1% of respondents met the third criteria for SA; 30.9% did not meet the criteria for *active engagement with life.*

Model 2: Strawbridge

Believing that current definitions of successful aging placed too great an emphasis on health and physical functioning, Strawbridge and colleagues advocated that definitions be more inclusive of well-being to differentiate between those experiencing positive and negative outcomes in old age. In their study Strawbridge et al. (2002) used a single measure to identify *self-rated successful aging* by asking their sample to respond to the statement: "I am aging successfully (or aging well)". Responses were captured on a scale of agree strongly, agree somewhat, disagree somewhat, and disagree strongly. Only respondents who agreed strongly were classified as aging successfully.

For the Strawbridge measure "I am aging successfully (or aging well)", the CCHS, cycle 2.1 (2003) question, "Are you satisfied with your life in general" was used as a proxy. Although it is clear that these items measure different qualities of the aging experience, both focus on important measures of subjective wellbeing and so both provide strong contrasts to the objective criteria put forth by Rowe and Kahn. CCHS respondents who identified being very satisfied or satisfied with their life in general were recoded to represent satisfaction with life and classified as aging successfully. Those who indicated being neither satisfied or dissatisfied, dissatisfied or very dissatisfied were recoded as not satisfied with their life in general and classified as aging unsuccessfully.

Covariates

As illustrated in Table 1, four covariates (province, age in years, sex and marital status) were used from the CCHS to examine successful aging by the criteria for models 1 and 2. These demographic variables have been linked to health and wellbeing previously (Raphael, 2004).

To create the variable "social engagement", one of three measures used to identify one's level of engagement with life some optional content in the CCHS survey was required; Ontario, Manitoba, Alberta and British Columbia (B.C.) were the only provinces with respondents who completed the optional questions. Of total respondents (N=14,749), Ontario and British Columbia represented 39.6% and 27.6% respectively.

Table 1: CCHS Variables for Successful Aging Covariates

Covariates	N	%
Province		
Ontario	5846	39.6%
Manitoba	2038	13.8%
Alberta	2795	19.0%
British Columbia	4070	27.6%
Total	14749	100.0%
Age in Years		
60-64	3497	23.7%
65-69	3223	21.9%
70-74	2927	19.8%
75-79	2470	16.7%
80 +	2632	17.8%
Total	14749	100.0%
Sex		
Male	6056	41.1%
Female	8693	58.9%
Total	14749	100.0%
Marital Status		
Married	7659	52.1%
Common-Law	220	1.5%
Widow*	6117	41.6%
Single	715	4.9%
Total	14711	100.0%

* Category includes widowed, separated and divorced, CCHS Cycle 2.1, 2003

Age in years was classified in the CCHS in 5 year age groupings. Information on survey respondents 80 years and older was classified into one age group. The age grouping selected from the CCHS included 5 age groups: 60-64, 65-69, 70-74, and 80 years or more. Overall, the greatest number of respondents was found in the 60-64 age group (23.7%) and the least number of respondents in the 75-79 age group (16.7%). Sex was classified in the CCHS as Male and Female; 41.1% or respondents were male, and 58.9% were women.

Marital Status was classified into four categories in the CCHS as reflected in Table 1. The majority of individuals were either married (52.1%) or widowed (41.6%) at the time of the survey, compared to those that identified being in a common-law relationship or single.

CHAPTER FOUR: RESULTS

Model 1: Rowe and Kahn

The primary focus of the analysis was on identifying individuals aging successfully versus unsuccessfully by considering respondent scores on all three criteria of the Rowe and Kahn model (i.e., were actively engaged with life, had no functional limitation and did not report having a chronic condition). Our analyses also evaluated the number of respondents who a) met all criteria of successful aging; b) met none of the criteria and; c) met some of the criteria. Although 89.0% of respondents would be classified as unsuccessful by Rowe and Kahn's criteria, only 11.3% failed to meet any of the requirements of successful aging. The majority of respondents (77.7%) fell somewhere on the continuum between truly unsuccessful (having none of the three criteria) and successful aging (having met all criteria), a category we have classified as "moderately successful aging" (having two out of three criteria).

There were minor differences across the four provinces (see Table 2). British Columbia had the greatest proportion of their respondents classified as successfully aging (11.3%) while the lowest proportion of successful agers were from Ontario (10.8%). Similarly, Ontario had the highest percentage of respondents classified as unsuccessful (12.3%) and Manitoba and Alberta had the lowest proportion of unsuccessful agers (9.7%)

Table 2: Proportion of Respondents by Province in SA Categories

	Successful	Moderate	Unsuccessful
Ontario	10.8%	76.9%	12.3%
Manitoba	10.9%	79.3%	9.7%
Alberta	11.1%	79.2%	9.7%
British Columbia	11.3%	77.1%	11.6%

Age was used to examine the classification of CCHS cycle 2.1 participants 60 years of age or older in the aging successfully, moderately aging or unsuccessfully aging categories. The respondents were represented by 5 age groups (60-64, 65-69, 70-74, 75-79, ≥80) The greatest proportion of individuals in the aging successfully category represented the 60-64 and the 65-69 age groups at 17.4% and 13.7% respectively, with a decline in the proportion of successful agers from 7.0% to 4.4% with advancing age. Overall, the majority of respondents across all 5 age groupings were classified as moderately successful in aging.

There was also a trend towards an increase in the proportion of respondents classified as unsuccessfully aging with advancing age, as exemplified by scores in the unsuccessful aging category reflecting the 60-64 age group at 7.6% and the 80 years or more age group at 19.1%. As depicted in Figure 2, the proportion of those classified as moderately successful remain relatively stable across age groups.

Across sex, 13.7% of men were classified as aging successfully compared to 9.1% of women. Within sex, 78.9% of men were classified as moderately successful compared to 76.9% of women. As depicted in Table 3, a greater proportion of females (14.0%) were aging unsuccessfully compared to males (7.3%).

As shown in Table 4, of the respondents who identified marital status as widowed (inclusive of being separated and, or divorced), 8.3% were classified as aging successfully compared to 14.9% aging unsuccessfully, notably the highest proportion of unsuccessful agers. Of respondents within the marital status classifications *common-law* and *single*, 14.5% and 13.3% were classified as aging successfully.

Figure 2: Successful Aging Classifications over Time

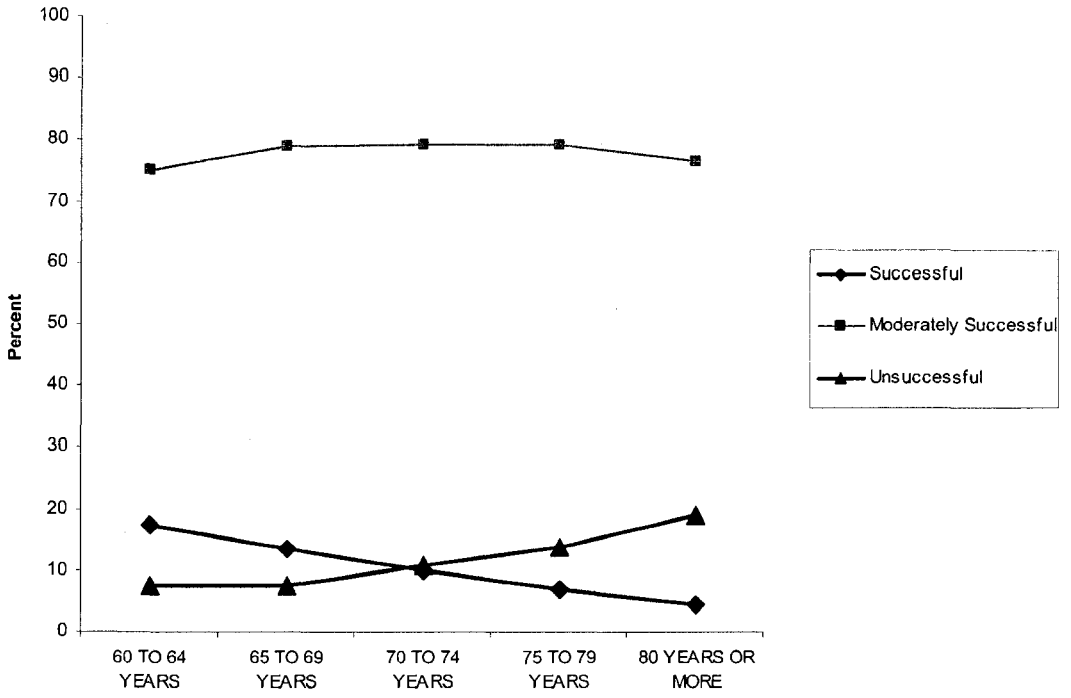


Table 3: Sex by Aging Classification

	Successful	Moderate	Unsuccessful
Male	13.7%	78.9%	7.3%
Female	9.1%	76.9%	14.0%

Table 4: Marital Status by Aging Classification

	Successful	Moderate	Unsuccessful
Married	12.9%	78.7%	8.4%
Common-Law	14.5%	77.7%	7.7%
Widow*	8.3%	76.8%	14.9%
Single	13.3%	75.4%	11.3%

** Inclusive of Widowed, Separated, and Divorced*

Model 2: Strawbridge

Of the respondents, 91.5% identified being satisfied with their life and therefore meeting the Strawbridge criteria for successful aging. A within province comparison (see Table 5) of satisfaction with life ranged from 92.7% of Ontarians, to 90.2% of respondents from British Columbia. Further, the greatest proportion of individuals not satisfied with their life in general were British Columbians (9.8%). Examination of scores by age showed little change in satisfaction with life scores with advancing age (see Table 6).

Table 5: Satisfaction with Life Scores Organized by Provinces and SA Category

	Successful	Unsuccessful
Ontario	92.7%	7.3%
Manitoba	91.4%	8.6%
Alberta	90.9%	9.1%
British Columbia	90.2%	9.8%

Table 6: Satisfaction with Life by Age Group Classified for Successful Aging

	Successful	Unsuccessful
60-64	91.0%	9.0%
65-69	92.4%	7.6%
70-74	91.6%	8.4%
75-79	91.6%	8.4%
80 +	90.9%	9.1%

Additionally, Table 7 shows that the proportion of male and female respondents, 92.1% and 91.1% respectively, were aging successfully when measured using the Strawbridge criteria.

Table 7: Satisfaction with Life by Sex Classified for Successful Aging

	Successful	Unsuccessful
Male	92.1%	7.9%
Female	91.1%	8.9%

Successful aging by marital status (Table 8) showed that of respondents identified as single, 88.3% are satisfied with their life in general. Of all married respondents, only 5.9% were classified as aging unsuccessfully, compared to 11.4% of those widowed, separated or divorced.

Table 8: Satisfaction with Life by Marital Status Classified for Successful Aging

	Successful	Unsuccessful
Married	94.1%	5.9%
Common-Law	90.8%	9.2%
Widow*	88.6%	11.4%
Single	88.3%	11.7%

* *Inclusive of Widowed, Separated, and Divorced*

Comparison of Model 1 and Model 2 Scores

A comparison of respondents' scores on Strawbridge criteria compared to scores on Rowe and Kahn criteria as displayed in Table 9, indicates strong agreement between the two models for those classified as unsuccessful. Of the respondents rated as unsuccessful by Strawbridge's criteria (8.5%), nearly 96% were also rated as unsuccessful by the Rowe and Kahn model. However, there was considerable disagreement in the proportion of respondents rated as successful between the two models. Specifically 91.5% of all respondents were classified as

successful by the Strawbridge criteria, but more than 88% of those respondents did not meet the Rowe and Kahn criteria.

Table 9: Comparison of Respondent Scores on the Strawbridge and Rowe and Kahn Models

	Rowe and Kahn	
	Successful	Unsuccessful
Rated successful by Strawbridge definition (91.5%)	11.7%	88.3%
Rated unsuccessful by Strawbridge definition (8.5%)	4.2%	95.8%

NOTE: moderately successful and unsuccessful in the Rowe and Kahn model were combined to create the 'unsuccessful' category.

Based on the variability between the two models, relative risk (RR) was computed using the formula: $RR = \frac{a/(a+b)}{c/(c+d)}$

where *a* is the number of respondents rated successfully by Strawbridge, *b* is the number of respondents rated unsuccessfully by Strawbridge, *c* is the number of respondents rated successfully by Rowe and Kahn and *d* is the number of respondents rated unsuccessfully by Rowe and Kahn. Calculated RR was 7.8, indicating that respondents had almost 8 times greater likelihood of being classified as aging successfully by the Strawbridge model than the Rowe and Kahn model.

Where Respondents Missed Meeting Rowe and Kahn's Criteria for Successful Aging

Additional descriptive analyses were conducted to determine where respondents failed to meet the Successful Aging criteria outlined by Rowe and Kahn's model. This data may prove valuable for strategically informing disease-related programs around prevention, patient self-management, tool development and health practitioner approaches.

Table 10: Proportion of Respondents Meeting Components of Rowe and Kahn's First Criteria

Chronic Disease	With Disease	No Disease
Asthma	7.7%	92.3%
Fibromyalgia	2.5%	97.5%
Arthritis or Rheumatism*	49.1%	50.9%
High Blood Pressure	40.2%	59.8%
Chronic Bronchitis	4.7%	95.3%
Emphysema or COPD	3.6%	96.4%
Diabetes	12.7%	87.3%
Heart Disease	17.0%	83.0%
Cancer	5.4%	94.6%
Urinary Incontinence	10.1%	89.9%
Stroke	3.5%	96.5%
Cataracts	17.6%	82.4%
Glaucoma	5.6%	94.4%
Back Problems	28.4%	71.6%

To identify the proportion of respondents that failed to meet Rowe and Kahn's first criteria of Successful Aging, *avoidance of disease or disease-related disability*, each of the 14 diseases were examined. As depicted in Table 10, of the respondents that identified living with a disease(s), almost 50% reported living with arthritis or rheumatism, followed by high blood pressure (40.2%), back problems (28.4%), cataracts (17.6%), heart disease (17.0%) and diabetes (12.7%). The least common diseases were fibromyalgia (2.5%) and stroke (3.5%).

To examine the second component of Rowe and Kahn's model, *high cognitive physical and functional capacity*, with the CCHS restriction of activities scale, Table 11 shows the seven categories of activities of daily living with the proportion of respondents who identified needing assistance, thus failing to meet a successful aging classification. The highest proportion of respondents reported requiring assistance with heavy household chores (31.9%), followed by assistance with common household chores and getting to appointments. The activities of daily living respondents identified as needing the least amount of assistance were for moving about inside the house (2.1%), personal care (3.9%) and preparing meals (4.5%).

Table 11: Proportion of Respondents Meeting Components of Rowe and Kahn's Second Criteria

Activities of Daily Living	Need Assistance	No Assistance
Preparing Meals	4.5%	95.5%
Getting to Appointments	12.5%	87.5%
Household Chores	13.1%	86.9%
Heavy Household Chores	31.0%	69.0%
Personal Care	3.9%	96.1%
Moving About Inside the House	2.1%	97.9%
Financial	5.2%	94.8%

Table 12 shows the proportion of respondents that failed to meet the components of the third criteria for Successful Aging, *active engagement with life*. Although 86.0% of respondents noted less than 35 hours of sedentary activity, and 74.4% had a strong sense of belonging, 54.7% did not meet the criteria, involvement in voluntary organization(s).

Table 12: Proportion of Respondents Meeting Components of Rowe and Kahn's Third Criteria

	Met	Not Met
< 35 hours of sedentary activity	86.0%	14.0%
Strong sense of belonging	74.4%	25.6%
Involvement in voluntary organizations	45.3%	54.7%

CHAPTER FIVE: DISCUSSION

The current study confirmed that the criteria used to define successful aging plays an important role in determining the proportion of a population that is classified as successful. Results showed that in applying the Rowe and Kahn criteria, only 11.0% of all respondents were classified as aging successfully, in comparison to 91.5% of respondents with the Strawbridge model.

Model 1 Rowe and Kahn's Three-Component Model of Successful Aging

Results indicate a wide range in the proportions of respondents who met each of the criteria of Successful Aging, supporting Rowe and Kahn's perspective that the criteria are not equal components in the model, but rather it is the combination that best represents the concept of successful aging.

The first criterion, avoidance of disease and disease-related disability (measured by "presence of chronic conditions") was the most restrictive component with only 18.6% of respondents meeting this requirement. In comparison, 66.6% of respondents met the requirement for maintenance of functioning and 69.1% of the sample that met the third criteria, active engagement with life. This suggests some similarity to the degree that these variables limit those who are successfully aging from those who are not; as a result, findings reinforce the view that the predominant factor in classifying SA, as defined by Rowe and Kahn (1987, 1998), is absence of disease and disease-related disability. Although in the current study, absence of disease was measured as the absence of 14 'age-related' chronic diseases with all conditions treated equally.

Merely looking at this level of Rowe and Kahn's criteria for successful aging does not yield appropriate direction to inform resources, research, education and practice toward

improving quality of life, investments in prevention and health maintenance, and enjoying more disease-free years as lifespan increases; as a result, variables were examined to identify the factors within each criteria that were restrictive in classifying an individual as aging successfully.

To identify the specific diseases that had the greatest contribution to the 89% of respondents who failed to meet Rowe and Kahn's first criteria, *avoidance of disease or disease-related disability*, each of the diseases were examined. Almost 50% reported living with arthritis or rheumatism, followed by high blood pressure (40.2%). Back problems, cataracts, heart disease and diabetes where the other leading conditions.

Of the respondents that failed to meet the second component of Rowe and Kahn's model, *high cognitive physical and functional capacity,* 31.9% reported requiring assistance with heavy household chores, while the least amount of assistance was identified for moving about inside the house, personal care and preparing meals. Additionally, of the three variables that make up the criteria *active engagement with life* (hours of sedentary activity, sense of belonging, and involvement in voluntary organizations), over half of the respondents did not identify involvement in voluntary organizations/associations.

Thus, future research should further examine the prominent chronic conditions (i.e., arthritis, rheumatism, high blood pressure), need for assistance with heavy household chores, and the involvement in voluntary organizations of seniors when identifying and investing in supports and programs to enable aging well.

Model 2 Strawbridge and Successful Aging as Subjective Wellbeing

In applying the Strawbridge model, a single qualitative measure to classify one as aging successfully, 91.5% of respondents 60 years of age and older identified being satisfied with their life. In their study (2002) Strawbridge et al., used a single measure to identify *self-rated*

successful aging by eliciting responses to the statement "I am aging successfully (or aging well)", to which only respondents who agreed strongly were classified as aging successfully. This resulted in 50.3% of their sample self-rating as aging successfully, compared to 18.8% when Rowe and Kahn's criteria were applied. Strawbridge et al. (2002) further noted that in using both models with the same population, several individuals who identified living with a chronic condition and functional difficulties, still perceived themselves to be aging successfully.

Considering such variance in the proportion of individuals that would be classified as aging successfully by these models, future research needs to examine the implications of using varying definitions of successful aging and further understand the criteria individuals use in forming personal assessments of how well they are aging.

A Comparison of the Models

The models of Strawbridge and of Rowe and Kahn represent the main two opposing views, or more simply, the dichotomy, of what constitutes successful aging. Both make unique and valuable contributions to the literature and focus on aging well throughout the lifespan. To expand our understanding of these models, including their benefits and limitations, this study provides an analysis of the implications the models have in a Canadian context.

Methodology focused on identifying individuals who are aging successfully versus unsuccessfully by examining respondent scores on the Rowe and Kahn model (i.e., were actively engaged with life, had no functional limitation and did not report having a chronic condition); however, analyses also examined the proportion of respondents who a) met all criteria of successful aging; b) met none of the criteria and; c) met some of the criteria. Findings showed that of the 89.0% of respondents classified as aging unsuccessfully 11.3% failed to meet any of the requirements. For the purpose of comparison between the two models, those classified in the

category of "moderately successful aging" (77.7%) were grouped with respondents categorized as aging unsuccessfully. Using the same Canadian sample from the CCHS, 91.5% were classified as aging successfully with the Strawbridge model, compared to 11.0% when applying Rowe and Kahn's 3-part definition. It appears that the main difference between the models relates to those identified as aging successfully.

In order to provide a usable, operational model of successful aging, sensitivity and specificity of the models needs to be determined. Sensitivity refers to accurately defining someone as aging successfully, whereas, specificity refers to accurately defining individuals who are aging unsuccessfully (Munro, 2005). However, in order to measure sensitivity and specificity, we would need to know which model is the correct tool to assess aging (i.e., determine the 'gold standard'). In consideration of the variable results between respondents classified as aging successfully by the Strawbridge and Rowe and Kahn models, and as advocated by Bowling and Dieppe (2005) and Depp and Jeste (2006), future research needs to focus on the development of an objective, theoretical model.

This highlights an area for future attention in an effort to more accurately define and develop additional, but appropriate, categories of aging as more specific classifications will yield greater insight into the health profile of the aging Canadian population.

Subjective Versus Objective Criteria in Defining Successful Aging

As will be outlined in the next section, the fact that the Strawbridge criteria did not change with advancing age may suggest that the measure needs to be further examined. With subjective measures like wellbeing and satisfaction reported through self-perception, the frame of reference is active. Baltes and Baltes (1990) purport that successful aging is a continuous process of change whereby constraints on an individual's aging are both unique and dynamic.

While recognizing the appeal to this view, objective measures of aging may be more practical assessment tools and yield tangible information for health care providers. Although limitations exist when applying the Rowe and Kahn model to these data, it is an objective method when examining the elements associated with aging throughout the lifespan.

Limitations of the Rowe and Kahn and Strawbridge Models

Using any explicit 'definition' of successful aging is to assume that individuals can be reasonably classified as aging successfully or unsuccessfully. Using the Rowe and Kahn model, the results suggest that the majority of Canadian seniors are not aging unsuccessfully, but more specifically, fall somewhere in the middle of the continuum of truly unsuccessful and successful. Recognizing the inequality of Rowe and Kahn's components, it may be more suitable for health professionals to examine one's risk profile for unsuccessful aging with a spectrum of classifications for aging.

Despite criticism from some in the gerontological community the Rowe and Kahn model maintains in a number of positive attributions. It is grounded in the premise that age-related deficits are not inevitable concomitants of old age and that environment and lifestyle factors ways well-being could be improved. In essence, this shifts focus to an individual's choices and effort.

Rowe and Kahn recognized that society does not make the transition into older ages easy, and advocated the need to make resources for successful aging more widely understood to increase the number of individuals who will age successfully, a position that has considerable meaning to countries such as Canada and the United States with rapidly aging populations.

In start contrast, the Strawbridge model focused on capturing and reflecting well-being – an individual's perception of their own aging, which was largely missing from Rowe and Kahn's

definition. Strawbridge and colleagues (2002) focused on comparing the prevalence and characteristics of older individuals from a representative sample who self-rated as aging successfully, versus those classified by Rowe and Kahn's criteria as successfully aging. This self-rated definition for successful aging may be useful for highlighting older individuals with low levels of well-being who may benefit from additional assessment or intervention.

Strawbridge et al. (2002) reiterated that successful aging is a complex concept and further examination into why some of their participants with no chronic conditions rated themselves as not aging successfully while others perceived themselves to be aging successfully may shed light on how quality and quantity of life may be promoted. In the current study, similar effects were seen. While both models were in good agreement with regard to those measured as unsuccessful, over 4% of respondents who met the more stringent Rowe and Kahn criteria did not rate themselves as satisfied by the Strawbridge model. Further work is necessary to understand the likely complex relationship between subjective measures of wellbeing, physical health and behaviour.

Even using the term successful is somewhat problematic because it implied classification of winners and losers; this placed gerontologist at some discomfort in language as trying not to imply that one was "unsuccessful" because they have a disability or a chronic illness. As a result, researchers and health professionals have moved to using other terms such as "healthy aging, aging well, effective aging, and productive aging". Strawbridge and colleagues, endorsed the need for tools to help in distinguishing between individuals who are and are not experiencing positive outcomes in old age across various dimensions, regardless of terminology used to improve the conceptualization and measure of successful aging. The absence of disease measure,

however, can be problematic since it denotes anyone with a chronic condition as aging unsuccessfully.

Effect of Demographic Covariates on Successful and Unsuccessful Aging

Of the four demographic covariates applied in this study to the Strawbridge and Rowe and Kahn models, results showed a distinct variance in the proportion of individuals classified as aging successfully by province, age, sex and marital status. The provinces with the greatest proportion of respondents classified as aging successfully were Ontario and British Columbia for the Strawbridge and Rowe and Kahn models respectively. It is interesting to further note that the most respondents classified as aging unsuccessfully were British Columbia and Ontarians for the Strawbridge and Rowe and Kahn models. This reiterates the lack of consistency between the two models.

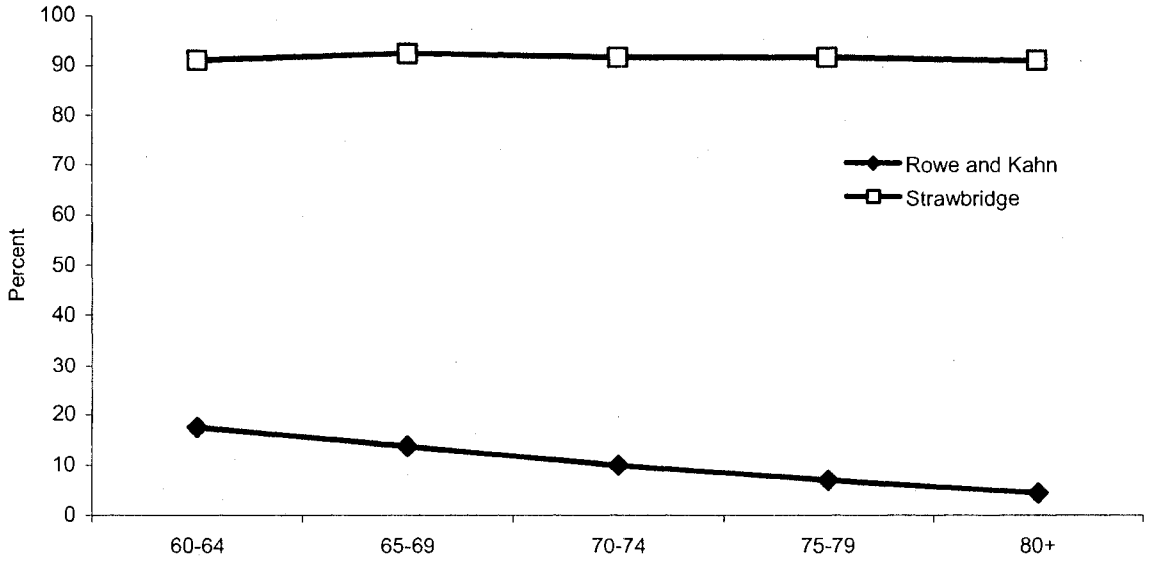
Discrepancies between the proportions of successful agers by age group for both models were evident. By the Rowe and Kahn model, the 60-64 age group held the greatest proportion of individuals classified as successful compared to the 65-69 age group for the Strawbridge model. The grouping '80 years or older' for both models had the highest proportion of unsuccessful agers. Moreover, there is a negative linear trend in the relationship of age and the likelihood of being classified as successful in the Rowe and Kahn model; however, this is not seen in the Strawbridge model results as represented in Figure 3. A possible explanation for the Rowe and Kahn results might be that as one ages, the likelihood of having chronic disease increases.

For sex, both models indicated that the greatest proportion of successful agers were male. However, differences between the models were still noted. There was less than a percent difference in the scores for male and female successful agers in the Strawbridge model, whereas the difference using the Rowe and Kahn criteria was 4.6%. It is possible that these findings are

influenced by a survivor effect. Recognizing that women live longer, it is also probable that this relationship is confounded by with male respondents being from a younger age group than females.

Of the four marital status categories, the greatest proportion of respondents classified as aging successfully were married and common law for the Strawbridge and Rowe and Kahn models respectively. The most respondents classified as aging unsuccessfully were in the categories of single and widowed for the Strawbridge and Rowe and Kahn models. One may perceive these results to be expected considering the known protective effect marriage has on health and the relationship of social integration that accompanies marriage and common-law relationships to health and quality of life (Aldwin and Gilmer, 2004). Overall, with such contradictory findings in the relationships between the demographics and the models, one is prompted to question the reliability and validity of the successful aging concept and these models in particular.

Figure 3: Comparison of Respondents Classified as Successfully Aging by Age



Limitations of the Current Study

Proxy measures from the CCHS for the Rowe and Kahn and Strawbridge models were developed to examine the profile of aging Canadians in four provinces specific to successful aging concepts. Of the Rowe and Kahn (1987) model of Successful Aging, the third component ***active engagement with life,*** was difficult to ascertain from the CCHS data. As mentioned previously designations of 'engaged' versus 'unengaged' are inherently subjective, thus we used a conservative approach using multi-level criteria was established to identify level of engagement with life by using three measures from the CCHS: *hours of sedentary behaviour, sense of belonging to local community* and *voluntary involvement in organizations.*

Sedentary activities included such actions as time spent on the computer, playing computer games video games and using the internet. Such activities may not be the most appropriate to include in looking where individuals, 60 years of age or more, spend their time. Additionally, the inclusion of age-related chronic diseases in the measure *avoidance of disease or disease-related disability* using the CCHS item *presence of chronic conditions* was dependent on the availability of conditions in the database. For example, Alzheimer's disease and dementia was not an available selection, and thus not reflected in the analyses and cancers were only separated out for sex. Moreover, each disease received the same weighting. Future analysis may look more specifically at a select number of age-related chronic conditions specific to the rates of and risk for certain diseases.

There are also important differences in the way Strawbridge's criteria was calculated in this study to that used by Strawbridge et al. (2002), which may account for the considerable differences in the proportion of people classified as aging successfully. Strawbridge and colleagues measured self-rated successful aging with the statement "I am aging successfully (or

aging well)", on a 4-point scale (agree strongly, agree somewhat, disagree somewhat, and disagree strongly). Only respondents who agreed strongly were classified as aging successfully as their sensitivity analysis indicated that those 'agreeing somewhat' were more similar to those who disagreed with the statement.

For this study, the proxy measure used for the Strawbridge model was, "Are you satisfied with your life in general?" on a 5-point scale. Individuals who identified being very satisfied or satisfied were classified as aging successfully; respondents that indicated being neither satisfied or dissatisfied, dissatisfied or very dissatisfied were classified as not aging successfully.

It is possible that the proxy measure of one's satisfaction with life assesses a quality different from Strawbridge's statement "I am aging successfully (or aging well)" and therefore, using them interchangeably may be seen as a limitation of this study. All the same, both are subjective measures and may have the same limitations. For example, single item scales do not have the same sensitivity as multi-item instruments and as a result, may be unable to distinguish between subjective wellbeing, satisfaction, and health related quality of life. Furthermore, subjective ratings of the quality' of one's aging process may be inherently biased by social perceptions of aging (Horton, Baker & Deakin, 2007). Future research is necessary to further examine the validity and appropriateness of using a single item to measure a variable whose complexity may be beyond the scope of a single question, and lend itself to a more dynamic, multi-faceted measure.

By using an existing database, the study was restricted to the variables measured by statistics Canada instead of being able to create a specific instrument that would target this research question. Originally, the CCHS was recognized for the inclusiveness of all provinces

and territories, which provided a highly generalizable representation of the Canadian population (with the exception of information from populations on Indian reserves, remote areas, and Canadian Forces Bases). However, due to the measures used in this study to identify respondents 60 years of age or older and who had answered all questions related to the variables under examination, data were obtained from 4 provinces. As a result, generalizability to the national level is limited.

Strengths of the Current Study

Strengths of the study included the use of the CCHS, which yielded the ability to compare individuals across the provinces of Alberta, British Columbia, Manitoba and Ontario, a dataset of 14,749 participants. In some cases groups of respondents were deliberately over-sampled to ensure that information collected on that group was accurate.

Criteria were objective for the Rowe and Kahn model, which improves the reliability of the method used. Despite the limitation of not having Alzheimer's and other dementias in the chronic disease measure, they still provided a detailed profile of age-related chronic disease prevalence.

Furthermore, the second component of Rowe and Kahn's model, *high cognitive and physical functional capacity*, was encapsulated in the CCHS database with the "restriction of activities" multi-item scale that was inclusive in measuring a range of physical activities; however, only one item dealt with cognitive function.

Study Implications

This information may prove valuable for strategically informing public health interventions with a population-based system-wide approach, drawing attention to best practices, innovation and the diversity of Canada's role in health promotion. It may also be timely with

respects to current discussions as concepts of health in a health promotion context are viewed by two lenses, one that is a broad, positive social concept of health, and the other, as the disease-oriented, biomedical concept of health (Raeburn & Rootman, 2007).

The activities of daily living, as analyzed in the Rowe and Kahn model, will be important measures to examine further, as they can inform which resources need to be available to enable seniors to remain at home. Similarly, the data for the chronic disease measure indicates that specific diseases should be targeted to a greater extent than others. Attention to arthritis prevention, for example, may result in a greater proportion of respondents meeting the Rowe and Kahn criteria for absence of a chronic condition.

Recognizing that a significant change in life span expectancy has already occurred, we (researchers, practitioners, older adults) must look at complimenting this change with the aim to sustain quality of life, and maintenance of full function, as long as possible. Further examination into profiling the proportions of Canadians who are aging successfully by the definitions of Rowe and Kahn and Strawbridge et al., may have implications for directing more efficient and effective policy, interventions and resources, once a more detailed picture of the health of our aging population is known.

Conclusions

Examination of the aging profile of the Canadian population and the methods and models used to do so is timely, considering the substantial commitment of resources dedicated to enable Ontarian seniors to age in their own homes is evident by the recent provincial launch of a three-year, $700 million provincial strategy. This Aging at Home, health care sustainability strategy recognizes the high utilization rate of seniors on health system services and aims to match care needs to the appropriate providers at the appropriate time with local community support services.

The strategy identifies investments that help seniors reside in their home and increases equity and access to services across the province by alleviating system pressures related to the utilization of hospitals and emergency rooms, and the prevention of premature institutionalization, through upfront investments in community supports.

This thesis examined two of the extremes of successful aging models. One focused entirely on a subjective measure and the other focused on objective and easily definable criteria. After consideration of the models' limitations and strengths using the CCHS dataset, the integration of both models may provide the most useful approach to understanding this phenomenon in the interim. Future research needs to concretely define successful aging to support an objective, theoretical model. Such a model would then yield the ability to measure sensitivity and specificity and clearly move towards the development of a true gold standard for examining successful aging. Optimal strategies to enhance one's aging experience will impact variables at the personal, social, and economic level.

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